

REMARKS/ARGUMENTS

Status of Claims:

Claims 1-26 were pending in the application; claims 18, 19, and 23-26 are hereby cancelled without prejudice or disclaimer of subject matter contained within. Claims 1-17 and 20-21 are now pending. Each of the pending claims defines an invention that is novel and unobvious over the cited art. Favorable consideration of this case is respectfully requested.

Summary of the Present Invention:

The present invention relates to formation of a lithographic image on a bilayer resist. The invention further relates to forming the image into a high-aspect ratio, three-dimensional pattern by etching with a sulfur-containing plasma. The process of etching with sulfur-containing plasmas creates undesirable sulfite and sulfate species. A further aspect of the present invention, not present in any art cited by the Examiner, is the chemical reduction, *in situ*, of the sulfate and sulfite species. The chemical reduction of the present invention is an active redox process. The active redox process is in contrast to the merely non-oxidative process of the cited art.

Objections to the Specification:

The Abstract was objected to because line 3 should recite "H₂" instead of H₂." The Abstract is hereby amended as indicated by the Examiner.

The specification was objected to for reciting an Attorney Docket Number to refer to a co-pending application simultaneously filed with the present application. The specification is hereby amended to refer to the co-pending application by its publication number (which was not available at the time of filing of the instant application). The instant specification referred to the co-pending application by Attorney Docket Number 0140/00268. The co-pending application may have been filed under the client's docket number: YOR92000064US1. Either number refers to Patent application publication US 2003/0017711.

The specification was objected to as failing to provide proper antecedent basis for the subject matter of claim 21. At page 8, a new paragraph is hereby inserted by amendment to recite materials originally present in claims 20 and 21.

None of the amendments are believed to have introduced new matter.

Claim Objections:

Claims 5 and 6 were objected to for improperly depending from claim 3. Claims 5 and 6, which further define passivating chemistries, are hereby amended to depend from claim 4 which recites passivating chemistry.

Rejection Under 35 U.S.C. § 102(b):

Claims 1, and 3-6 were rejected under 35 U.S.C. § 102(b) as being anticipated by Ohkuni (EP 903777).

Rejection under 35 U.S.C. § 102 requires the prior art disclose each and every limitation of the claimed invention (MPEP § 706.02). In determining anticipation, no claim limitation may be ignored. See *Pac-Tex, Inc. v. Amerace Corp.*, 14 USPQ2d 1871 (Fed. Cir. 1990). Anticipation requires the disclosure, in a prior art reference, of each and every recitation as set forth in the claims. See *Titanium Metals Corp. v. Banner*, 227 USPQ 773 (Fed. Cir 1985), *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 1 USPQ2d 1081 (Fed. Cir 1986), and *Akzo N.V. v. U.S. International Trade Commissioner*, 1 USPQ2d 1241 (Fed. Cir 1986). There must be no difference between the claimed invention and reference disclosure for an anticipation rejection under 35 U.S.C. § 102. See *Scripps Clinic and Research Foundation v. Genentech, Inc.*, 18 USPQ2d 1001 (CAFC 1991) and *Studiengesellschaft Kohle GmbH v. Dart Industries*, 220 USPQ 841 (CAFC 1984). The evidentiary record fails to teach each limitation of the present invention in view of the silence of Ohkuni regarding the chemical reduction of sulfur species.

The Examiner cites Ohkuni as teaching etching a resist with a sulfur-containing plasma, thereby generating sulfur-containing species. Ohkuni teaches removing the

sulfur species by treating with a gas devoid of sulfur. Examples of gasses, cited by the Examiner, include: N₂, O₂, Ar, and He. As is known by persons of skill in the chemical arts, none of the gasses cited by the Examiner are reducing gasses. Oxygen, O₂, is the classic oxidizer, oxygen is the exact opposite of a reducing gas. Argon and helium are noble gasses that tend not to participate in any electron transfer (redox) reactions whatsoever. Nitrogen is a stable gas that tends not to be involved in redox chemistry. Non-of the gasses cited by the Examiner is a reducing gas.

Ohkuni does not meet the teachings of the present invention. Claim 1 of the present invention recites treating the image with a "chemically-reducing plasma." Ohkuni does not teach chemical reduction. Rather, Ohkuni relates to plasma processing an etched image using a gas "containing no S component such as N₂ gas to remove the S component." (My emphasis). (Page 13, lines 18-19). The plasma processing of Ohkuni may also be performed using O₂, Ar, or He. (Page 14, lines 18-19).

Rejection Under 35 U.S.C. § 103(a):

Claims 2, 9-17, and 20-21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohkuni in view of Allen (5,985,524).

To establish *prima facie* obviousness of a claimed invention, all the claim recitations must be taught or suggested by the prior art. *In re Royka*. All words in a claim must be considered in judging the patentability of that claim against the prior art. *In re Wilson*. (MPEP § 2143.03). When evaluating the scope of a claim, every limitation in the claim must be considered. See e.g. *In re Ochiai*. (MPEP § 2144.08). The evidentiary record fails to teach each recitation of the present invention. Specifically, the references taken as a whole or severally fail to teach chemically-reducing sulfate and/or sulfite species.

As discussed above, in context of the § 102 rejection, Ohkuni is silent as to chemical reduction. Therefore, Ohkuni fails to teach each recitation of the present invention as required to sustain a § 103 rejection. In context of the present § 103

rejection, Ohkuni teaches away from the present invention. Ohkuni teaches plasma processing a sulfur-containing resist with oxygen gas. Oxygen is an oxidizing gas that, chemically, is exactly the opposite of a reducing gas. Teaching away from the invention is a *per se* demonstration of nonobviousness. U.S. v. Adams, 338 U.S.39, 148 U.S.P.Q. 479 (1966).

Allen does not complete the teachings Ohkuni because, as the Examiner acknowledges, Allen is silent as to chemical reduction.

Claims 7 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohkuni in view of Agunero (JP2000-200832).

As discussed above, Ohkuni is silent as to chemical-reduction and, moreover, teaches an oxidizing gas (O₂). Agunero does not complete Ohkuni. Agunero is silent as to the reduction of sulfur species. Agunero relates to the reduction of copper interconnects. Agunero nowhere mentions sulfur. Agunero defines "reducing plasma" to mean "non-oxidizing." "This reducing plasma is a non-oxidizing, i.e., oxygen-atom-free plasma atmosphere." (Abstract). The plasma of Agunero contains at least one "non-oxidizing" gas including noble gasses. (Para 0013). As discussed above, noble gasses are not reducing, they are merely non-oxidizing because they do not participate in redox reactions. Moreover, Agunero is not properly combinable with Ohkuni because Agunero's plasma must exclude oxygen, whereas Ohkuni's plasma may contain oxygen.

Conclusion:

In view of the above, consideration and allowance are, therefore, respectfully solicited.

Accordingly, it is respectfully requested that the foregoing amendments be entered, that the application as so amended receive an examination on the merits, and that the claims as now presented receive an early allowance.

If the Examiner believes that an interview would facilitate the prosecution of this case, Applicants urge the Examiner to contact the undersigned at the telephone number listed below.

The undersigned hereby authorizes the Commissioner to charge any insufficient fees or credit any overpayment associated with this communication to deposit account no. 22-0185.

Respectfully submitted,

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John A. Evans, Reg. No. 44,100
Attorney for Applicants
Connolly Bove Lodge & Hutz LLP
1990 M Street, N.W.
Washington, DC 20036-3425
Telephone: 202-331-7111
Facsimile: 202-293-6229

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